

Scientometric Analysis Of Coral Reef Research Publications

Dr.L.N.Umadevi
Assistant Professor
Department of Library and Information Science
Annamalai University
Annamalai Nagar-608 002

K.Sivasami
Assistant Professor
Department of Library and Information Science
Annamalai University
Annamalai Nagar-608 002

Abstract

The present study aims to analysis, Scientometric analysis of coral reef research publications. The data were collected from web of science database, the study period during from 2004 to 2018. The data have been collected from web of science database the number of retrieved records were 5306. The study reveals that during the study period in the year 2016 has occupies first place with 481 records, overall year wise growth has rising two times from starting year. Thirteen document types were contributed in this research, article document type were first place, totally 112 countries were contributed in this research, USA has toppe amongst with 2137 publications and its share 40.27 percent of total Publications, Totally 9927 authors were contributed, amongst Bellwood, D R has contributed first position with 116 publications. Totally 725 sources were contributed in coral reef research amongst "Coral Reefs" has contributed highest contributions with 523 records. Multiple authored papers are highest contributions compare with single author contributions.

Keywords: Coral reefs, Coral animals, Dead coral, Ecosystems, Tiny animals.

Introduction

Coral reefs are composed of calcium carbonate, which is secreted by the coral animals. A coral reef is made up of millions of tiny animals called polyps and their homes. A coral reef is usually made up of layers of dead coral covered only by a thin outside skin of live coral. Coral reefs are the most productive shallow water ecosystems in the world. The Jamaica Environment Trust (2016), Ang PO, Choi MM, Choi LS, So KY, Tam MC, (2004), Bak RPM (1983). Climate change and anthropogenic stress currently threaten the world's coral reefs, thereby undermining the livelihoods of large human populations. Coral reefs are coming under more and more pressures to provide fisheries resources as income and food for people in developing countries Wilkinson, Clive R. (2004), Fujiwara S. et al. (2000), Glynn P. W, (1993). The coral reef ecosystems underpin the economies of the countries in the region, particularly fisheries and tourism sectors, and provide livelihood opportunities and income for local communities Global Coral Reef Monitoring Network (2017), Jokiel, P.L, Coles S.L, (1990), Kan H, Hori N, Nakashima Y, Ichikawa K (1995). Coral reefs are invaluable for the riches in biodiversity and essential resources for the sustainable livelihoods of many coastal communities. Biodiversity is an important factor in all healthy ecosystems. Coral reef ecosystems support an incredibly diverse community of fish species Newton, Katie, Isabelle M. Côté, Graham M. Pilling, Simon Jennings, and Nicholas K. Dulvy, (2007), Ota Y, Omura A, (1992), Tsuchiya M, Nojima S, (2002) Coral reefs play a key role in the livelihoods of hundreds of millions of coastal dwelling poor people. Millions of people are dependent upon coral reef fisheries for food Ehrenfeucht, Shivani, (2014), Veron J E N, (1992).

Methodology

The data were collected from web of science database, study period during from 2004 to 2018. The search string used 'Coral Reef' in the title field was used to extract publications related to Coral reef 5306 records were retrieved from web of science database; the data were downloaded and analyzed by using the Microsoft office Excel spreadsheet application as per objectives of the present study.

Objectives

- To find out year wise publications of Coral Reef research publications
- To identify document wise contribution of Coral Reef
- To analysis language wise publication
- To examine institution wise publication of Coral Reef
- To examine authorship pattern
- To find out subject wise distribution

Relative Growth Rate (RGR)

The relative growth rate is the increase in the number of publications/pages per unit of time. Here, one year is taken as the unit of time. The mean relative growth rate $R(1-2)$ over a specified period of interval can be calculated from the following equation suggested by Mahapatra (1985).

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

Where,

- R = Mean relative growth rate over the specific period of interval;
 $W1$ = $\log w1$ (Natural log of initial number of publications/ pages);
 $W2$ = $\log w2$ (Natural log of initial number of publications/pages);
 $T2-T1$ = Unit difference between the initial time and final time.

Therefore,

- $R(a)$ = Relative growth rate per unit of publications per unit of time (year)
 $R(p)$ = Relative growth rate per unit of pages per unit of time (year)

Doubling Time (DT)

A direct equivalence exists between the relative growth rate and doubling time. If the number of publications/pages of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. This difference has a value of 0.693. Thus, the corresponding doubling time for publication and pages can be calculated by the following formula:

$$\text{Doubling time (Dt)} = \frac{0.693}{R}$$

Therefore,

$$\text{Doubling time for publications Dt (a)} = \frac{0.693}{R(a)}$$

Analysis and Interpretation

Table 1 Year wise Coral Reef research performance

Sl. No.	Publication Years	Records	Percentages
1	2004	222	4.18
2	2005	251	4.73
3	2006	260	4.90
4	2007	261	4.92
5	2008	313	5.90
6	2009	290	5.47
7	2010	301	5.67
8	2011	348	6.56
9	2012	367	6.92
10	2013	432	8.14
11	2014	422	7.95
12	2015	461	8.69
13	2016	481	9.07
14	2017	459	8.65
15	2018	438	8.26
	Total	5306	100.00

Table 1 indicates that, year wise publication in Coral Reef research, totally 5306 papers published, during the study period years in the 2016 has occupies first place with 481 records, 2015 has second place with 461 records, 2017 has third place with 459 papers, followed by 2011 has 348 records, in 2018 published 438 papers, 2013 have 432 papers, in 2014 have published 422 papers, in 2008 have published 313 papers, in 2010 have published 301 papers, in 2009 have published 290, in 2007 have published 261 papers, in 2006 published 260 papers, in 2005 have published 251 papers and in 2004 have published 222 papers in this research.

Table 2 Relative Growth Rate and Doubling Time of Coral reef research

SL. No	Publication Years	No. Of Records	Cumulative	W1	W2	W1-W2 (R)	Mean (a) 1-2	Doubling Time	Mean Dt (a) 1-2
1	2004	222	222		5.4		0.08		0.12
2	2005	251	473	5.4	5.53	0.13		0.13	
3	2006	260	733	5.53	5.56	0.03		0.13	
4	2007	261	994	5.56	5.56	0		0.12	
5	2008	313	1307	5.56	5.75	0.19		0.12	
6	2009	290	1597	5.75	5.67	-0.08	0.06	0.12	0.12
7	2010	301	1898	5.67	5.71	0.04		0.12	

8	2011	348	2246	5.71	5.85	0.14		0.12	
9	2012	367	2613	5.85	5.91	0.06		0.12	
10	2013	432	3045	5.91	6.07	0.16		0.12	
11	2014	422	3467	6.07	6.05	-0.02		0.11	
12	2015	461	3928	6.05	6.13	0.08		0.11	
13	2016	481	4409	6.13	6.18	0.05		0.11	
14	2017	459	4868	6.18	6.13	-0.05		0.11	
15	2018	438	5306	6.13	6.08	-0.05	0.00	0.11	0.11
	Total	5306					0.04		0.11

Table 2 shows that, Relative Growth Rate and Doubling Time, during the study period publications Doubling Time mean value are 0.11. In 2004, the Coral reef research publication was 222; gradually the research publications were raised to 438 in the year 2018. The relative growth rate mean is 0.04.

Table 3 Document wise research performance in Coral Reef

Sl. No.	Document Types	No. of records	Percentages
1	Article	4447	83.81
2	Review	192	3.62
3	Editorial Material	190	3.58
4	Meeting Abstract	137	2.58
5	Proceedings Paper	120	2.26
6	news Item	79	1.49
7	Correction	62	1.17
8	Letter	42	0.79
9	Book Chapter	25	0.47
10	Book Review	8	0.15
11	Data Paper	2	0.04
12	Software Review	1	0.02
13	TV Review Radio Review	1	0.02
	Total	5306	100.00

Table 3 indicates that, document wise research performance on coral Reef. Totally thirteen document types were contributed in this research publication, Article document type were first place with 4447 papers were contributed, review has second place with 192 papers, Editorial Material has third place with 190 records, and followed by meeting abstract has 137 papers, Conference Proceedings Paper has 120 papers, news Item has 79 records, Correction has contributed 62 papers, Letter type has 42 papers Book Chapter has published 25 papers, Book Review has 8 records. Data paper has 2 records, and Software Review and TV Review Radio Review document were contributed 1 record respectively.

Table 4 Language wise research output in Coral Reef

Sl.No.	Languages	No. of records	Percentages
1	English	5242	98.79
2	Spanish	32	0.60
3	French	16	0.30
4	German	3	0.06
5	Malay	3	0.06
6	Russian	3	0.06
7	Chinese	2	0.04
8	Japanese	2	0.04
9	Italian	1	0.02
10	Portuguese	1	0.02
11	Slovenian	1	0.02
	Total	5306	100.00

Table 4 Language wise research performances in Coral Reef, totally eleven languages were contributed in this research. Majority of papers were published in English, followed by Spanish has second place with 32 records, in French 16 papers were published, in German, Malay, and Russian 3 records published were respectively, in Chinese, and Japanese has contributed 2 records respectively, and Italian, Portuguese, and Slovenian have contributed 1 records respectively.

Table 5 top fifteen countries contributed in coral reef research

Sl.No.	Countries	No. of records	% of 5306
1	USA	2137	40.27
2	Australia	1736	32.71
3	England	456	8.59
4	France	390	7.35
5	Japan	257	4.84
6	Germany	255	4.80
7	Canada	254	4.78
8	Mexico	198	3.73
9	Netherlands	191	3.6
10	New Caledonia	155	2.92
11	Peoples R China	150	2.82
12	Brazil	135	2.54
13	Israel	123	2.31
14	New Zealand	108	2.03
15	Taiwan	102	1.92

Table 5 shows that coral reef research performance on top fifteen countries which have contributed more than 100 and above publications, among the top fifteen countries USA has topper among the countries with 2137 publications and its share 40.27 percent of total Publications, Australia has second place with 1736 records and its share 32.71 publications, England has third place 456 publications its share 8.59 percentages, France has fourth place its share 7.35 percent of publications, Japan has fifth place its share 4.84 percent of publications, Germany has sixth place with 4.80 percent of publications, Canada has seventh place its share publications 4.78 percent, Mexico has eight place, Netherlands has ninth place, New Caledonia has tenth place, Peoples R China has eleventh place, Brazil has twelfth place, Israel has thirteenth place, New Zealand has fourteenth place with, amongst Taiwan has fifteenth place with 102 and its share publications 1.92 percent publications.

Table 6 top fifteen authors Contributes in coral reef research output

Sl. No.	Authors	No. of records	% of 5306	Rank
1	Bellwood D R	116	2.18	1
2	Jones GP	104	1.96	2
3	Mumby P J	104	1.96	2
4	Mccormick M I	81	1.52	3
5	Graham NAJ	79	1.48	4
6	Mcclanahan T R	76	1.43	5
7	Pratchett M S	68	1.28	6
8	Munday P L	65	1.22	7
9	Hoegh-Guldberg O	63	1.18	8
10	Wild C	62	1.16	9
11	Edmunds P J	51	0.96	10
12	Hoey A S	50	0.94	11
13	Wilson S K	50	0.94	12
14	Lecchini D	48	0.90	13
15	Willis BL	47	0.88	14
16	Van Oppen M J H	46	0.86	15

Totally 9927 authors were contributed in coral reef research, amongst top fifteen authors contributed listed in the table 6, Bellwood, D R has contributed 116 papers with first place, Jones, G P , and Mumby, P J has second place with 104 records respectively, Mccormick MI has third place with 81 records contributed, followed Graham NAJ has fourth place with 79 records, Mcclanahan T R has fifth place, Pratchett M S has sixth place, Munday P L has seventh place, Hoegh-Guldberg O has eighth place, Wild C has ninth place, Edmunds P J has tenth place, Hoey A S has eleventh place, Wilson S K has twelfth place, Lecchini D thirteenth place, has Willis BL fourteenth place, and Van Oppen M J H has fifteenth place with 46 records, more than 45 records were contributed authors listed in this tale.

Table 7 authorship pattern in coral reef research

Sl. No.	No. of Authors	No. of Papers	Percentage
1	Single	892	16.81
2	Double	974	18.36

3	Three	1243	23.43
4	Four	918	17.30
5	Five	382	7.20
6	Six and Above	897	16.91
	Total	5306	100.00

Table 7 shows that authorship pattern in coral reef research publications during the study period, among the 5306 papers single author contributing are 16.81 percentages, followed by Double authors were contributed 18.36 percent of authors, Three authors were contributed 23.43 percent of papers, Four authors were contributing 17.30 percent of papers, five authors wear contributing 7.20 percent, and remaining six and above authors were contributed 16.91 percent of papers. Could be noted, single authors were contributing 16.81 percent only the remaining 83.19 percent of papers are collaborative author papers.

Table 8 top fifteen Sources contributed on Coral reef research publications

Sl.No.	Source Titles	No. of contributions	% of 5306
1	Coral Reefs	523	9.86
2	Marine Ecology Progress Series	300	5.65
3	PLOS One	295	5.56
4	Marine Pollution Bulletin	192	3.62
5	Marine Biology	120	2.26
6	Journal of Experimental Marine Biology and Ecology	90	1.70
7	Scientific Reports	81	1.53
8	Integrative and Comparative Biology	74	1.40
9	Bulletin of Marine Science	69	1.30
10	Proceedings of the Royal Society B Biological Sciences	69	1.30
11	Science	67	1.26
12	Global Change Biology	63	1.19
13	Revista de Biologia Tropical	60	1.13
14	Limnology and Oceanography	54	1.02
15	Estuarine Coastal and Shelf Science	53	1.00

Table 8 shows that top fifteen Sources contributed on Coral reef research publications, totally 725 sources were contributed in coral reef research, amongst top fifteen Sources presents in table 6 “Coral Reefs” has contributed 523 records, “Marine Ecology Progress Series” have contributed 300 records, “PLOS One” has contributed 295 records, “Marine Pollution Bulletin” has 192 records, “Marine Biology” have published 120 records, “Journal of Experimental Marine Biology and Ecology” has contributed 90 records, “Scientific Reports” have published 81 records, “Integrative and Comparative Biology” have contributed 74 records, “Bulletin of Marine Science” has 69 records, Science has 67 records, “Global Change Biology” has contributed 63 papers, “Global Change Biology” has 63 papers, “Revista de Biologia Tropical” has contributed, 60 papers, “Limnology and Oceanography” has 54 papers, “Estuarine Coastal and Shelf Science” has contributed 53 papers, and the remaining sources were contributed less than fifteen sources.

Table 9 top fifteen institutions contributed in coral reef research

Sl.No.	Institutions	No. of records	% of 5306
1	James Cook university	694	13.08
2	University Queensland	394	7.43
3	Australian Inst. Marine Sci.	380	7.16
4	University Miami	168	3.17
5	University Western Australia	148	2.79
6	NOAA	144	2.71
7	University Hawaii	142	2.68
8	James Cook University N Queensland	139	2.62
9	University Calif San Diego	134	2.53
10	University Hawaii Manoa	132	2.49
11	Wildlife Conservat Soc	109	2.05
12	University Perpignan	108	2.04
13	University Calif Santa Barbara	98	1.85
14	University Exeter	95	1.79
15	University Nacl Autonoma Mexico	91	1.72

Table 9 shows that listed top fifteen institutions contributed in coral reef research, James Cook university” has first place with 694 records, James Cook university” has second place with 394 records, “Australian Inst. Marine Sci.” has third place with 380 records, followed by “University Miami” has contributed 168 records, “University Western Australia” has contributed 148 records, “NOAA” has 144 records, “University Hawaii” has 142 records, “James Cook University N Queensland”, has 139 records, University Calif San Diego” has 134 records, “University Hawaii Manoa” has 132 records, Wildlife Conservat Soc has 109 records, “University Perpignan” has 108 records, University Calif Santa Barbara” has 98 records contributed, University Exeter” has 95 records, University Nacl Autonoma Mexico” has 91 records contributed, moreover the remaining 2951 sources were century contributed 2330 records.

CONCLUSION

Conclude from the study, year wise publication found in Coral Reef research in year 2016 has occupies first place with 481 records the remaining years were contributes below 9 percent of publications., totally eleven languages were contributed in this research majority of papers were published in English, totally 112 countries were contributed in this research amongst USA has topest countries with 2137 publications and its share 40.27 percent of total publications. Bellwood, D R has contributed in Coral Reef research 116 papers Jones, G P, and Mumby, P J has second place with 104 records respectively. Totally 725 sources were contributed in coral reef research, amongst “Coral Reefs” has contributed highest publications, “James Cook university” has first place with 694 records in coral reef research, moreover single author contributions are less compare with collaborative author publications.

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